

Appendix H

Methodology

A quantitative method was needed to analyze whether geographic differences in child care prices could be explained by differences in local economic conditions. A multivariate regression model was chosen for its capability to simultaneously assess multiple economic factors while adjusting for other factors that are not measures of the local economy, but which do affect providers' costs and prices.

The regression model(s) were developed using the providers who responded to the DSHS 1998 survey as the study population. The models tested the extent to which each provider's prices were correlated with, and could be "predicted" by, the economic conditions in the county and the operational characteristics of the particular center or home.

Unfortunately, local economic data are not available for sub-areas within counties, so county-level data was used. Economic conditions, such as labor and real estate markets, can vary significantly within large counties, and child care is a relatively local market. Parents usually choose providers near either home or work, for obvious reasons of time and transportation costs. Some generally-available county level data is less reliable or even unavailable for the smallest counties.

Given the economic differences among for-profit centers, nonprofit centers, and family homes, separate regression models were developed for each type of provider. Local economic factors that proved the best "predictors" were county housing costs and the level of prevailing wages for child care workers in the county. The model also adjusted for operational characteristics, such as size of the center or home, and whether they provided care for infants (which requires high staffing levels).

Two factors were considered which might be viewed as either local economic indicators or operational characteristics. The first was whether or not medical benefits were provided to staff. This could be seen as either an operational choice of the type of staff, or as part of necessary labor compensation and therefore an indicator of local labor market conditions. The extent of minority children served could also be seen as either reflecting the socio-economic strata which a provider focused on serving, or the demographic and economic makeup of the neighborhood in which the provider was located. Although both of these factors are significant in some regressions, they are not dominant determinants of prices. It does not change the basic interpretation of the regression results whether one thinks of either of these two factors as local economic indicators or as indicators of a provider's operational characteristics.

To avoid confusing market effects with the effects of the DSHS reimbursement system, the data from the regression model excluded centers where more than 85 percent of the children are subsidized by DSHS, and the prices charged DSHS-subsidized children served in family homes. These are the same exclusions used by DSHS in their rate setting analysis. Government-operated centers were also excluded; this consists of both the Headstart operators excluded from the DSHS rate setting process and other government-operated centers.

All variables are drawn from the 1998 DSHS survey data except for the housing cost data used in both models and the countywide wage data used in the family homes model. The wage data used in the center models were compiled as countywide averages, and not used as data specific to individual providers. The regression models are designed to measure the positive, negative, or non-existent correlation of these indicators with provider prices, as measured by price (centers) or average price (homes) for full-time preschool age children. Preschool age children are the largest age group in licensed care, and most providers serve some children of that age. In order to use the price data for which there was the largest number of providers and children in care, the price for the preschool age group was chosen as the dependent or predicted variable for the regression analysis.

In modeling for-profit and nonprofit centers (excluding government centers), the indicators are measured as follows. Wages are measured as a countywide mean of reported wage rates for teachers and aides, weighted by center size. Monthly housing cost indices are based on the price of a 1,500 square foot house purchased or rented in 1998.¹ The percentage of minority children served by a center includes all children who are not white. Child care centers located in a church, a school, another public building, or in an employer-provided facility were coded as having subsidized rent. Center size is measured by the total number of people employed. The effect of employee benefits is captured by whether or not employees receive medical benefits. Finally, the percentage of full-time infants served indicates the extent to which centers serve the most expensive age group.

For family homes, several indicators were measured slightly differently. Wages are measured as the 1998 median county wage for Census Standard Industrial Classification system for the category including residential care and social services (category 836). Monthly housing cost and medical insurance are measured the same way for home providers as for centers. Race, and staffing ratio effects are measured by whether or not the home provider serves children of color and infants. Education is measured by the number of years of formal education a home provider has, ranging from less than a high school degree to a

¹Overall cost of housing data from the Economic Research Institute, including interest, utilities, and taxes.

graduate degree. The number of hours per week with an assistant indicates staff size, while the number of children in care indicates provider size.

The regression models used in this analysis (ordinary least squares (OLS)) assume, among other things, a linear relationship between the market factors and monthly preschool age prices, and that the error terms in the model have certain properties². There is evidence that both assumptions are not distorting in all three models. Since R^2 is a measure of correlation and the models have high R^2 s (around .5 for centers and .3 for homes), the relationship between the market factors and care prices appears to be well estimated as linear. In addition, non-linear transformations of wage and housing cost were tested and did not change the results. Variation in error terms (heteroscedasticity) or significant outliers could not be detected in plots of residuals and predicted values of each model. Further, when each regression model is run with a different mathematical formulation (not OLS) with more robust standard errors, there are no notable changes in the results. There is some collinearity between wage and housing cost in all three models. However, the contribution that each market factor makes –independently of all other factors – to the explanation of preschool age prices (tolerance) is high enough that multi-collinearity is not a problem. These results suggest that the findings of the enclosed regression models are reliable.

Results

Local economic conditions and operational characteristics of childcare providers explain an exceptionally large amount of the variation in monthly preschool age prices. The factors used in the regression models for nonprofit and for-profit centers explain more than half of the variation in preschool age prices.³ The indicators in the home provider model explain almost a third of the variation in preschool age prices⁴ (In comparison, explaining 20 percent or more of variation is often considered a substantial result in many social science regression models). The model with the best fit is that of for-profit centers, which is not surprising, since that group of providers is most tightly tied to the local economy and market factors. The lesser fit in the case of home providers (standard error of regression for for-profit centers of 72.39 compared to 90.01 for homes) possibly results from the great variance in how home providers value and charge for the costs of their facilities, which are also their residences. Almost three quarters of all for-profit and home providers from the DSHS survey are included in the models (N of included for-profits = 347; N of included home providers = 1,059). Because nonprofit centers have a larger number of missing responses on key variables, only 56 percent of all nonprofit centers from the DSHS survey are included in the regression model (N=322).

² The error terms are assumed to be homoscedastic and not auto-correlated.

³ See the R^2 for nonprofit centers of .516 (or 52 percent) and the R^2 for for-profit centers of .534 (or 53 percent).

⁴ See the R^2 for home providers of .314 (or 31 percent).

Factors that contribute to increases in prices

Wages, housing costs, and staff size contribute to statistically significant higher prices for all types of providers. For instance, for every dollar increase in the hourly wage rate, monthly nonprofit center prices increase by \$40, controlling for the other variables. And for every \$100 increase in monthly housing costs, monthly for-profit center prices increase by \$14, controlling for the other variables.

Serving infants and providing medical insurance to staff only make statistically significant contributions to higher prices for some types of providers, while having no detectable impact on others. Among for-profit centers only, providing medical insurance to staff has a statistically significant and sizable effect on prices. Monthly prices average \$46 higher at centers offering health benefits than at centers that do not. Serving full-time infants does not affect preschool age prices at nonprofit centers and family homes, but is linked to slightly higher prices at nonprofit centers. Data on the effect of staff education levels are only available for home providers. As expected, monthly preschool age prices increase with a home provider's education level (for every additional year of education, monthly prices increase by \$6). The impact of a home provider having taken early childhood development classes was tested in another version of the regression model, with negative results.

Factors that contribute to decreases in monthly preschool age prices

At nonprofit centers, subsidized rents result in an average \$28 decrease in monthly preschool age prices. Serving minority children is a significant variable for nonprofit centers and home providers, and is associated with lower prices. For home providers, serving children of color is related to monthly preschool age prices that average \$11 lower than the prices of other home providers. For home providers, while additional assistant time is linked to higher prices, additional children in home care are associated with lower prices, indicating economies of scale. With every additional child in home care, monthly preschool age prices decrease by an average of \$3.

Summary

Wages, housing costs, staff size, and education are associated with higher preschool age care prices. Medical insurance correlates with higher prices only at for-profit centers, and caring for infants correlates with higher prices only at nonprofit centers. Family home providers with more education tend to charge higher prices. Lower prices are related to rent subsidies (for nonprofits), serving children of color (for nonprofits and home providers), and number of children served (for home providers).

Regression Model: Determinants of Monthly Prices for Full-Time Pre-School Age in Washington State's Non-profit Child Care Centers (N=322)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.718 ^a	.516	.505	75.0783

a. Predictors: (Constant), Percent fulltime infants, Rent subsidy yes/no, Percent minority kids, Total # people employed, Survey county wage (weighted mean), Medical benefit yes/no, Monthly housing cost

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1884934	7	269276.292	47.772	.000 ^a
	Residual	1769939	314	5636.749		
	Total	3654873	321			

a. Predictors: (Constant), Percent fulltime infants, Rent subsidy yes/no, Percent minority kids, Total # people employed, Survey county wage (weighted mean), Medical benefit yes/no, Monthly housing cost

b. Dependent Variable: Preschoolers full-time monthly rate (<85% DSHS kids)

Coefficients^a

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	-106.659	50.523		-2.111	.036		
Survey county wage (weighted mean)	39.690	10.228	.280	3.880	.000	.297	3.372
Monthly housing cost	.156	.028	.400	5.521	.000	.294	3.406
Percent minority kids	-.471	.144	-.129	-3.258	.001	.980	1.020
Rent subsidy yes/no	-28.498	9.257	-.121	-3.079	.002	.995	1.005
Total # people employed	1.943	.517	.153	3.758	.000	.928	1.077
Medical benefit yes/no	7.736	8.834	.036	.876	.382	.906	1.103
Percent fulltime infants	1.463	.531	.110	2.754	.006	.967	1.034

a. Dependent Variable: Preschoolers full-time monthly rate (<85% DSHS kids)

Regression Model: Determinants of Monthly Prices for Full-Time Pre-School Age in Washington State's For-profit Child Care Centers (N=347)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.731 ^a	.534	.524	72.3905

a. Predictors: (Constant), Percent fulltime infants, Percent minority kids, Medical benefit yes/no, Rent subsidy yes/no, Survey county wage (weighted mean), Total # people employed, Monthly housing cost

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2033948	7	290563.996	55.447	.000 ^a
	Residual	1776490	339	5240.382		
	Total	3810438	346			

a. Predictors: (Constant), Percent fulltime infants, Percent minority kids, Medical benefit yes/no, Rent subsidy yes/no, Survey county wage (weighted mean), Total # people employed, Monthly housing cost

b. Dependent Variable: Preschoolers full-time monthly rate (<85% DSHS kids)

Coefficients^a

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	-34.098	46.995		-.726	.469		
Survey county wage (weighted mean)	30.333	10.268	.220	2.954	.003	.249	4.019
Monthly housing cost	.139	.030	.353	4.663	.000	.240	4.166
Percent minority kids	-.174	.161	-.041	-1.076	.283	.943	1.060
Rent subsidy yes/no	-4.046	9.178	-.017	-.441	.660	.977	1.023
Total # people employed	2.459	.486	.209	5.062	.000	.806	1.240
Medical benefit yes/no	45.616	8.822	.212	5.170	.000	.821	1.218
Percent fulltime infants	.443	.663	.026	.669	.504	.886	1.129

a. Dependent Variable: Preschoolers full-time monthly rate (<85% DSHS kids)

Regression Model: Determinants of Monthly Prices for Pre-School Age in Washington State's Family Homes (N=1,063)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.559 ^a	.312	.307	89.9428

a. Predictors: (Constant), Infants dummy, Education level in years, Minority kids yes/no, Median wage SIC836, Medical insurance dummy, # hrs/week with assistant, # kids in care, Monthly housing cost

ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3874575	8	484321.895	59.869	.000 ^a
	Residual	8526548	1054	8089.704		
	Total	12401123	1062			

a. Predictors: (Constant), Infants dummy, Education level in years, Minority kids yes/no, Median wage SIC836, Medical insurance dummy, # hrs/week with assistant, # kids in care, Monthly housing cost

b. Dependent Variable: Mean monthly rate pre-schoolers

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-33.646	36.131		-.931	.352		
	Median wage SIC836	9.892	4.595	.084	2.153	.032	.430	2.326
	Monthly housing cost	.192	.016	.457	11.638	.000	.422	2.367
	Minority kids yes/no	-11.007	5.745	-.051	-1.916	.056	.926	1.079
	# hrs/week with assistant	.492	.151	.094	3.254	.001	.782	1.279
	Education level in years	6.381	1.965	.084	3.247	.001	.973	1.028
	# kids in care	-2.611	.759	-.100	-3.439	.001	.774	1.292
	Medical insurance dummy	2.031	8.427	.006	.241	.810	.966	1.035
	Infants dummy	7.181	6.413	.029	1.120	.263	.945	1.058

a. Dependent Variable: Mean monthly rate pre-schoolers

	Median Annual (1)	Annual cost of(2)	Child Care (3)
County	Household Income	Housing	Survey Wage
Adams	30,113	9,722	
Asotin	33,223	12,700	6.56
Benton	44,841	14,169	6.57
Chelan	38,348	13,943	6.93
Clallam	31,162	14,353	7.89
Clark	47,353	14,844	6.97
Columbia	27,934	11,061	
Cowlitz	37,010	14,036	7.27
Douglas	34,927	13,843	9.63
Ferry	28,254	11,543	
Franklin	30,346	14,178	6.85
Garfield	30,062	10,927	
Grant	30,289	13,004	7.99
Grays Harbor	29,259	11,623	8.16
Island	37,691	16,721	7.77
Jefferson	33,446	15,109	
King	60,785	21,304	8.59
Kitsap	44,036	15,964	7.01
Kittitas	27,606	15,100	7.90
Klickitat	29,368	12,145	
Lewis	32,484	12,128	6.46
Lincoln	27,529	11,510	
Mason	33,719	14,494	7.13
Okanogan	23,696	12,308	5.77
Pacific	24,022	12,423	
Pend Oreille	30,857	11,714	
Pierce	43,624	16,641	7.25
San Juan	48,458	17,453	8.29
Skagit	39,998	14,442	7.48
Skamania	39,336	13,348	7.67
Snohomish	52,450	19,427	6.87
Spokane	37,712	14,063	6.60
Stevens	29,010	12,284	6.93
Thurston	43,475	16,310	
Wahkiakum	36,611	13,442	
Walla Walla	33,631	11,565	6.15
Whatcom	39,703	16,793	7.10
Whitman	29,779	12,444	7.53
Yakima	32,063	13,216	7.08

1-The median measures the income level at which half of all households have more income and half have less.
Median Income Information is available on the OFM web site.

2-Office of Financial Management obtained this housing cost data from the Economic Research Institute. The data used in the Child Care Rate Study was for a 1,500 square foot house. This index includes rent and utilities for renters. It includes mortgage and interest payments, taxes and utilities for families buying their home.

3-Child Care wages by county compiled from DSHS survey responses averaging the wage rates center providers report paying their staff.